# The professional advantage: Quadro versus GeForce

For most workstation customers, NVIDIA's Quadro professional graphics cards provide significant additional value compared to GeForce consumer graphics cards. Quadro cards provide superior performance for certified workstation-class applications, are designed and tested rigorously for high reliability, manufactured with high quality, and offer significantly better support.

Application performance

Application certifications
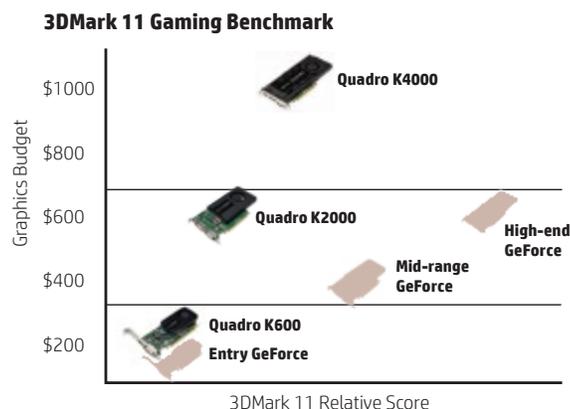
Reliability

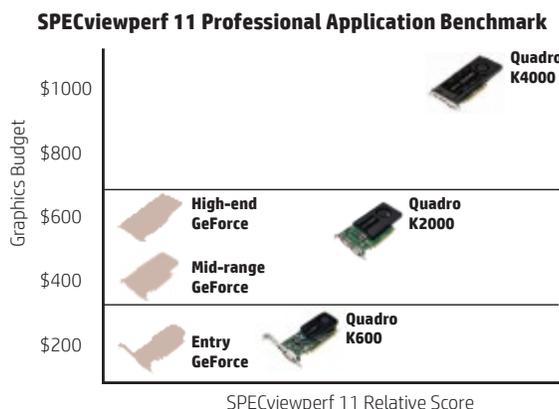Quadro customer value

Support

Quality
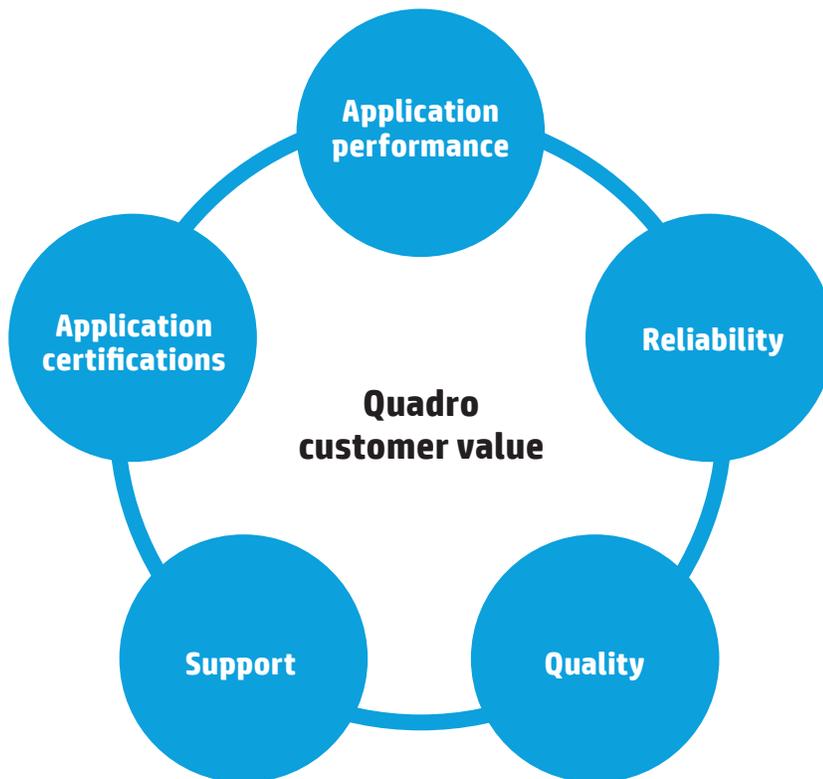
Application certifications

HP and NVIDIA work very closely with professional application ISVs (Independent Software Vendors) such as Autodesk, Siemens, Dassault Systemes, and many others, to ensure that these applications are fully certified on Quadro graphics solutions. In most cases, professional applications are not certified on GeForce graphics. Certification provides a number of important benefits, including:

• The ISVs have tested their applications on certified Quadro hardware and drivers, so the applications will perform more reliably and often with higher performance.

• The ISVs will support customers who run their applications on certified Quadro hardware and drivers.

• HP and NVIDIA provide key ISVs with early access to new Quadro hardware, which then enables customers to deploy a fully certified Quadro solution shortly after product launch.

• HP and NVIDIA and ISVs work closely together to ensure that applications continue to provide a reliable, high-performance experience for customers even after the initial certification.

• HP Performance Advisor tool can assist in the selection and installation of drivers for a wide selection of certified professional applications on HP Workstations. In addition, HP Performance Advisor can help with selecting the right system BIOS settings and driver settings to optimize for different workloads and applications.

Application performance

Quadro solutions are optimized to provide workstation-class professional application performance across a wide-range of price points, while GeForce cards provide great performance for games.

Hardware and driver optimization for
Professional Applications   **Quadro**

Hardware and driver optimization for
Games   **GeForce**

SPECviewperf 11 Professional Application Benchmark

Graphics Budget

$1000   Quadro K4000

$800

$600   High-end GeForce   Quadro K2000

$400   Mid-range GeForce

$200   Entry GeForce   Quadro K600

SPECviewperf 11 Relative Score

3DMark 11 Gaming Benchmark

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$600   Quadro K2000   High-end GeForce

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$200   Quadro K600
Entry GeForce

3DMark 11 Relative Score

The SPECviewperf 11 benchmark is often used as an approximation of performance for professional applications that use OpenGL. The chart above shows the geometric mean performance of all the application viewsets in SPECviewperf 11 for a selection of Quadro and GeForce cards. Notice that even inexpensive Quadro cards such as the Quadro K600 outperform high-end GeForce cards for the professional applications represented by SPECviewperf 11.

The 3DMark 11 benchmark is often used to evaluate the gaming performance of graphics cards. The chart above shows the relative 3DMark 11 scores for a selection of Quadro and GeForce cards. As previously mentioned, the GeForce cards generally provide very good performance for gaming benchmarks.

Reliability

Graphics card reliability is a critical consideration for most HP Workstation customers who realize that any downtime from a failed card can be very costly. Since the brand's inception, Quadro cards have been designed for high reliability, and rigorous testing by both HP and NVIDIA ensure a high-quality customer experience. Examples of design enhancements on Quadro cards that are not typically seen on GeForce cards include:

- Extenders to improve mechanical integrity and stability by engaging guides in the front of the chassis card cage.
- Thicker gold plating on PCIe connectors for better electrical integrity and corrosion resistance.
- ECC (Error Correcting Code) memory on high-end Quadro cards to ensure data integrity by correcting for occasional single-bit errors.
- Significantly larger memory capacity to improve performance for applications using textures, display lists, vertex buffer objects, or GPU computing; enables more data to be kept in graphics card memory for faster access.
- Quadro cards sold by HP are tuned to optimize acoustic and thermal performance of the card in HP Workstations.
- Components on Quadro cards, such as the fan, are carefully selected to ensure they provide high reliability and long life.

Unlike GeForce cards, Quadro cards are required to pass extensive hardware and software tests conducted by both HP and NVIDIA in HP Workstation platforms. These include thermal, acoustic, power, and "shake and shock" tests to ensure that the card operates with sufficient margin even under extreme conditions. Quadro cards are tested for compatibility with a wide selection of HP Displays. Extensive driver testing is done using HP's proprietary graphics test suite and includes performance, functionality, reliability, and stress tests.

Quadro cards are all manufactured by NVIDIA and qualified by HP, so they are assured to all be subject to the same standards and testing processes described above. GeForce cards, manufactured by a variety of third parties, may be tested differently by different OEMs (Original Equipment Manufacturers), and it is possible for them to vary by manufacturer and over time.

Quadro cards are available either Configure to Order (CTO) or as After Market Options (AMO) on HP Workstations. In either case, they come with the appropriate power adapters needed for use in HP Workstations. GeForce cards must be purchased separately and often the power adapters must also be purchased separately.


Extender
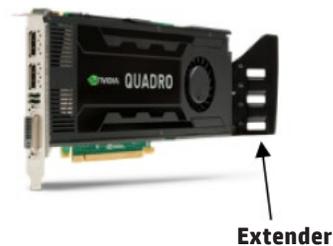
Quality

Quadro graphics cards are manufactured to exacting quality standards. GeForce cards are manufactured by a variety of independent hardware vendors with variable and often inconsistent quality. Below shows results in three aspects of manufacturing quality obtained for Quadro and three different suppliers of GeForce cards.[1]

[1] Quality testing and comparisons were conducted by Hewlett Packard in the Fort Collins, CO. USA Material Analysis Laboratory. GeForce cards used were commercially purchased. The GeForce cards represent comparable GPU technology as used in the NVIDIA Quadro 6000 (NVIDIA GF 100 GPU).

Solder quality

Through hole solder joints hold critical electronic parts down on the printed circuit board. The IPC standard requires at least 75% of the barrel be filled with solder for a truly reliable joint. Through hole solder joints hold in important components like video cable connectors. Some consumer cards violate the IPC standard. This can lead to early product failure. Conversely, a Quadro 6000 card not only meets the specification, it exceeds it by having 100% barrel fill and very nice filleting.
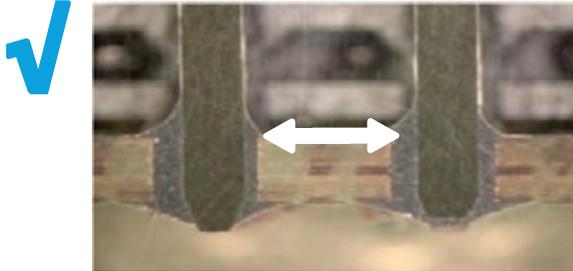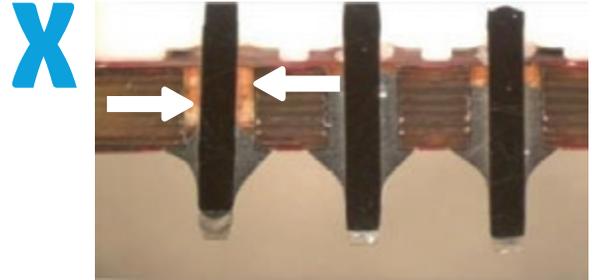
Excellent filleting and full barrel fill
Quadro 6000—optimal
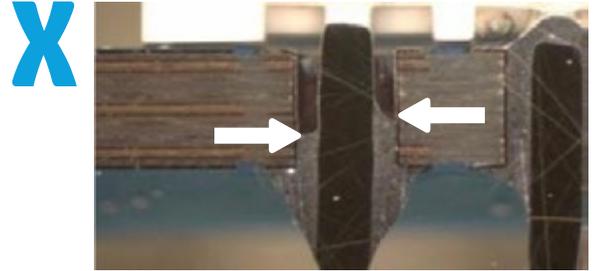
Incomplete barrel fill, no fillet
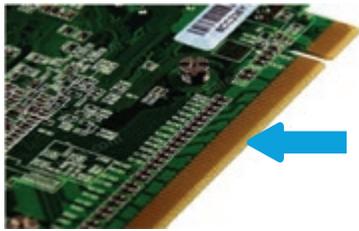Consumer vendor 1—defective
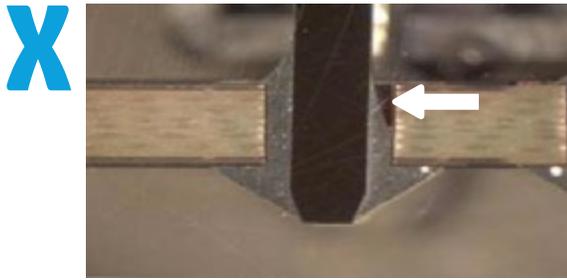
Consumer vendor 2—barely acceptable

Consumer vendor 3—extremely defective

Connector plating

Edge connectors should be plated with at least 30 micro-inches of gold to provide long-term reliability. Gold does not corrode, and provides an airtight seal for base metals.

Quadro cards have 30 micro-inches of gold

Micro-inches of gold

	Quadro	Vendor 1	Vendor 2	Vendor 3
40				
30				
20				
10				
0				
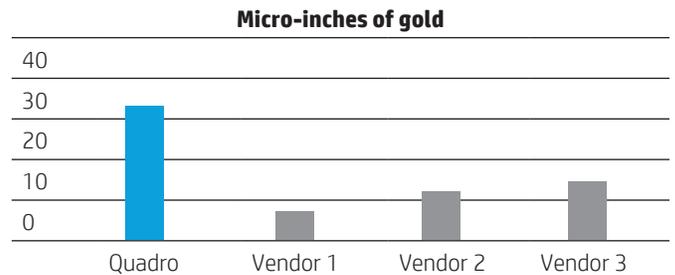
X The customer cards are below 15 micro-inches and could experience early lifetime failures

PCI Specification compliance

To ensure compatibility and reliability, all PCIe cards must comply with the PCI Express specification. Some consumer cards are poorly designed, even violating the specification. In this example below, the consumer card design includes components in a region of the card that is designated by the specification as a "keep out" area. As a result, the components get sheared off when the card is inserted into a workstation slot that meets the specification.
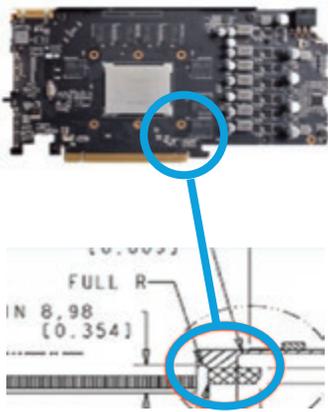
Components in area specified as "keep out"
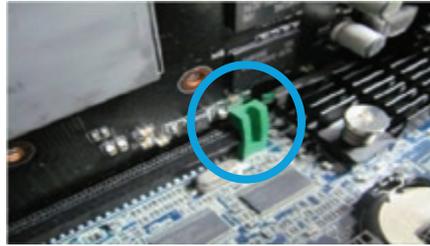
Components are sheared off when the card is inserted into a workstation slot that meets specification

Card lifecycle and support

HP Workstation customers recognize that HP and NVIDIA provide support for Quadro graphics solutions that is far superior to support available from OEMs for GeForce cards. The table below highlights several aspects of support that customers should consider.

	Quadro	GeForce
Typical card lifecycle	18 to 24 months or more	6 to 9 months
Typical warranty duration	3 years	90 days to 1 year
Warranty provider	HP and NVIDIA	OEM
Dedicated enterprise support	HP and NVIDIA	No
HP qualified and supported drivers	Yes	No
Drivers via Microsoft Windows update	Yes	No

HP Workstation dedicated enterprise support is a tiered support structure that engages the right level of technical support required to solve even the most complex customer graphics issues on HP Workstations, including hardware, driver, and professional application support. In the case of issues with professional applications, our HP Workstation support specialists will work in concert with the support provided by professional application ISVs, adding insights and expertise specific to HP Workstations in order to ensure a timely resolution.

Thanks to the longer lifecycle of Quadro cards, HP hardware warranty support is usually able to replace defective graphics cards with new cards that are completely compatible, so there is no need for a driver change or other change to the customer operating system image.

Conclusion

Although price is an important consideration when selecting a graphics solution purchase, other factors discussed in this document typically have an even greater influence on the Total Cost of Ownership (TCO) for the graphics solution. Over the lifetime of the product, NVIDIA Quadro solutions deliver significantly greater value than GeForce solutions for professional workstation users:

• Quadro cards are certified for workstation-class applications to provide a stable, reliable, and responsive user experience for HP Workstation customers.

• Quadro cards and drivers are highly tuned to deliver superior performance for the workstation-class applications that matter most to our HP Workstation customers.

• Quadro cards are designed and tested rigorously to ensure the high reliability demanded by HP Workstation customers.

• Quadro cards are manufactured to exacting quality standards.

• Quadro cards are backed by a longer warranty and enterprise support so that when issues do arise, HP Workstation customers can have confidence that HP and NVIDIA will work together to resolve those issues quickly and thoroughly.

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